Quick Start

This example is not intended to tell you everything you need to know about programming and starting-up a complex control system. It is only intended to give you an opportunity to demonstrate to yourself and others the basic steps necessary to power up the PLC and confirm its operation. Please look for warnings and notes throughout this manual for important information you will not want to overlook.

Step 1: Unpack the DL06 Equipment

Unpack the DL06 and gather the parts necessary to build this demonstration system. The recommended components are:

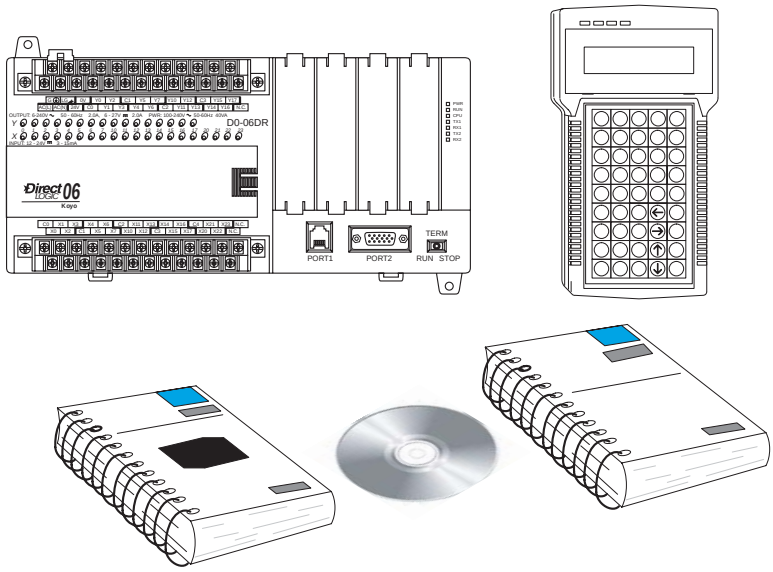
- DL06 Micro PLC
- AC power cord or DC power supply
- Toggle switches (see Step 2 on next page).
- Hook-up wire, 16-22 AWG
- DL06 User Manual (this manual)
- A small screwdriver, 5/8" flat or #1 Philips type

You will need at least one of the following programming options:

- ***Direct***SOFT32 Programming Software V4.0 or later (PC-PGMSW or PC-PGM-BRICK), ***Direct***SOFT32 Manual (included with the software), and a programming cable (D2-DSCBL connects the DL06 to a personal computer)

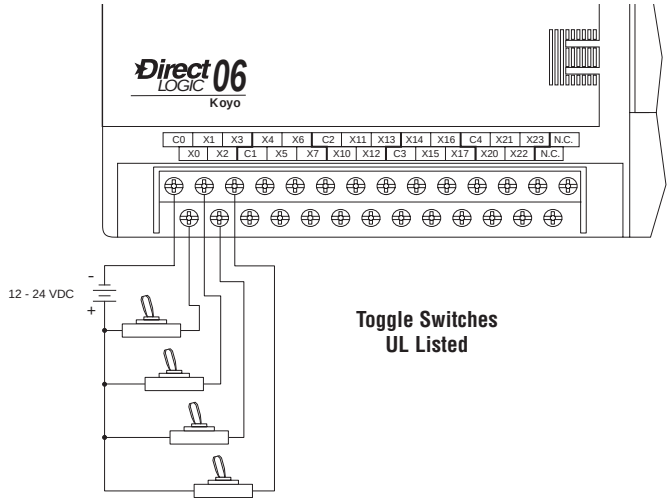
or

- D2-HPP Handheld Programmer, firmware version 2.20 or later, (comes with programming cable). Please purchase Handheld Programmer Manual D2-HPP-M separately.



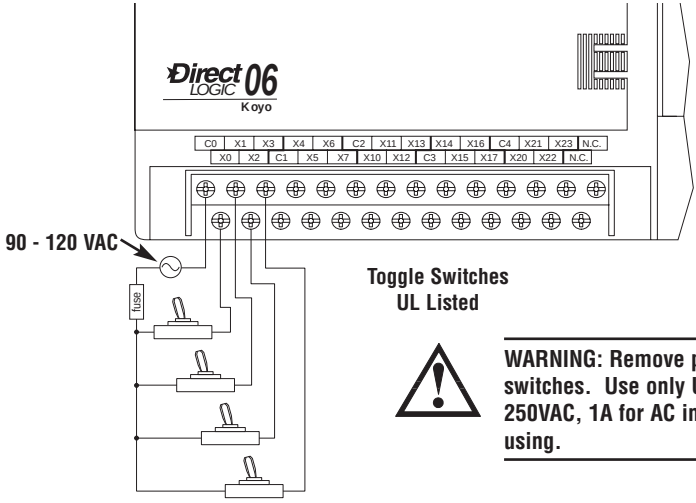
Step 2: Connect Switches to Input Terminals

To proceed with this quick-start exercise or to follow other examples in this manual, you will need to connect one or more input switches as shown below. If you have DC inputs on an AC-supply DL06, you can use the auxiliary 24VDC supply on the output terminal block or other external 12-24VDC power supply. Be sure to follow the instructions in the accompanying **WARNING** on this page.



D0-06DA, D0-06DD1, D0-06DD2, D0-06DR, D0-DD1-D, and D0-06DR1-D DC Input

Toggle Switches UL Listed



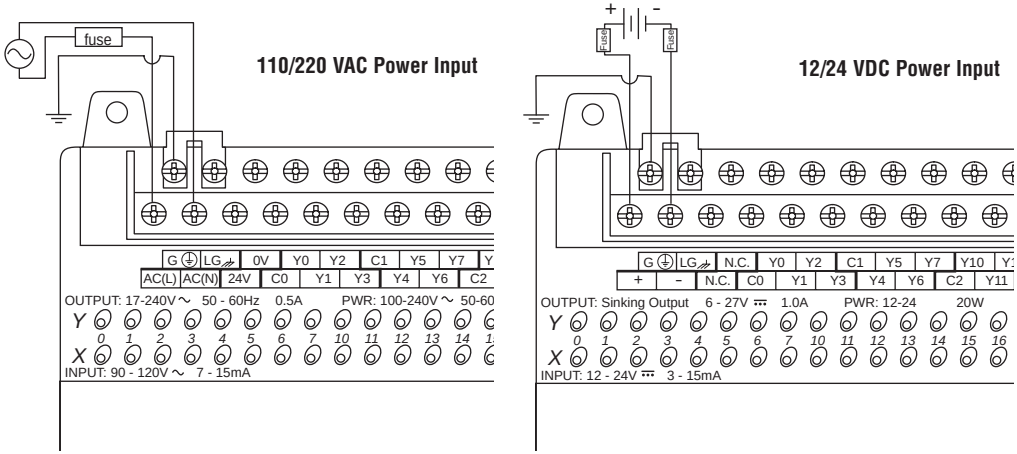
D0-06AA and D0-06AR AC input only

Toggle Switches UL Listed

WARNING: Remove power and unplug the DL06 when wiring the switches. Use only UL-approved switches rated for at least 250VAC, 1A for AC inputs. Firmly mount the switches before using.

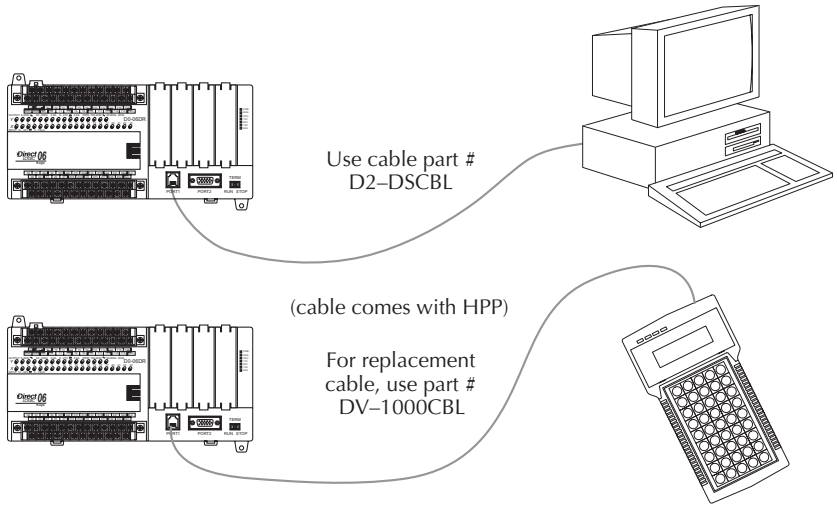
Step 3: Connect the Power Wiring

Connect the power input wiring for the DL06. Observe all precautions stated earlier in this manual. For more details on wiring, see Chapter 2 on Installation, Wiring, and Specifications. When the wiring is complete, close the connector covers. Do not apply power at this time


fuse
110/220 VAC Power Input
G LG 0V Y0 Y2 C1 Y5 Y7
AC(L) AC(N) 24V C0 Y1 Y3 Y4 Y6 C2
OUTPUT: 17-240V ~ 50 - 60Hz 0.5A PWR: 100-240V ~ 50-60
INPUT: 90 - 120V ~ 7 - 15mA
+ -
fuse
fuse
12/24 VDC Power Input
G LG N.C. Y0 Y2 C1 Y5 Y7 Y10
+ - N.C. C0 Y1 Y3 Y4 Y6 C2 Y11
OUTPUT: Sinking Output 6 - 27V 1.0A PWR: 12-24 20W
INPUT: 12 - 24V 3 - 15mA

Step 4: Connect the Programming Device

Most programmers will use *Direct*SOFT32 programming software, Version 4.0 or later, installed on a personal computer. An alternative, if you need a compact portable programming device, is the Handheld Programmer (firmware version 2.20 or later). Both devices will connect to COM port 1 of the DL06 via the appropriate cable.



Note: The Handheld Programmer cannot create or access LCD, ASCII or MODBUS instructions.

Step 5: Switch on the System Power

Apply power to the system and ensure the PWR indicator on the DL06 is on. If not, remove power from the system and check all wiring and refer to the troubleshooting section in Chapter 9 for assistance.

Step 6: Initialize Scratchpad Memory

It's a good precaution to always clear the system memory (scratchpad memory) on a new DL06. There are two ways to clear the system memory:

- In *Direct*SOFT32, select the PLC menu, then Setup, then Initialize Scratchpad. For additional information, see the *Direct*SOFT32 Manual. Initializing Scratchpad will return secondary comm port settings and retentive range settings to default. If you have made any changes to these you will need to note these changes and re-enter them after initializing Scratchpad.
- For the Handheld Programmer, use the AUX key and execute AUX 54.

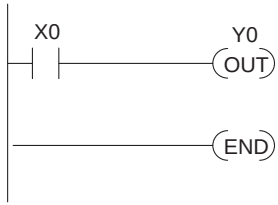
See the Handheld Programmer Manual for additional information.

Step 7: Enter a Ladder Program

At this point, *Direct*SOFT32 programmers need to refer to the Quick Start Tutorial in the *Direct*SOFT32 Manual. There you will learn how to establish a communications link with the DL06 PLC, change CPU modes to Run or Program, and enter a program.

If you are learning how to program with the Handheld Programmer, make sure the CPU is in Program Mode (the RUN LED on the front of the DL06 should be off). If the RUN LED is on, use the MODE key on the Handheld Programmer to put the PLC in Program Mode, then switch to TERM.
Enter the following keystrokes on the Handheld Programmer.

Equivalent *Direct*SOFT32 display



CLR	CLR					Clear the Program
C 2	E 4	AUX	ENT	ENT	CLR	
NEXT	$ STR	→	A 0	ENT		Move to the first address and enter X0 contact
GX OUT	→	A 0	ENT			Enter output Y0
SHFT	E 4	N TMR	D 3	ENT		Enter the END statement

After entering the simple example program put the PLC in Run mode by using the Mode key on the Handheld Programmer.

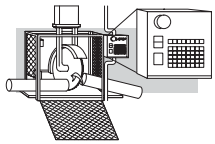
The RUN indicator on the PLC will illuminate indicating the CPU has entered the Run mode. If not, repeat this step, ensuring the program is entered properly or refer to the troubleshooting guide in chapter 9.

After the CPU enters the run mode, the output status indicator for Y0 should follow the switch status on input channel X0. When the switch is on, the output will be on.

Steps to Designing a Successful System

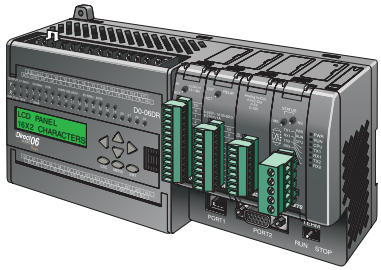
Step 1: Review the Installation Guidelines

Always make safety the first priority in any system design. Chapter 2 provides several guidelines that will help you design a safer, more reliable system. This chapter also includes wiring guidelines for the various versions of the DL06 PLC.



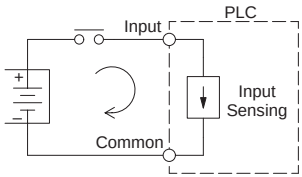
Step 2: Understand the PLC Setup Procedures

The PLC is the heart of your automation system. Make sure you take time to understand the various features and setup requirements.



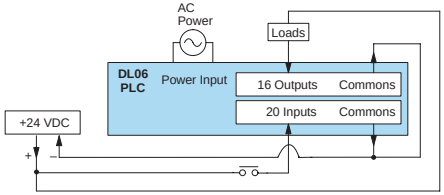
Step 3: Review the I/O Selection Criteria

There are many considerations involved when you select your I/O type and field devices. Take time to understand how the various types of sensors and loads can affect your choice of I/O type.



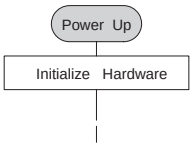
Step 4: Choose a System Wiring Strategy

It is important to understand the various system design options that are available before wiring field devices and field-side power supplies to the Micro PLC.



Step 5: Understand the System Operation

Before you begin to enter a program, it is very helpful to understand how the DL06 system processes information. This involves not only program execution steps, but also involves the various modes of operation and memory layout characteristics.

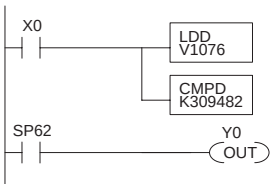


Step 6: Review the Programming Concepts

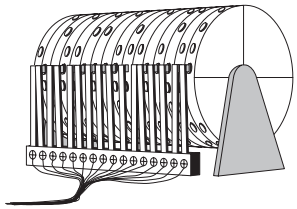
The DL06 PLC instruction set provides for three main approaches to solving the application program, depicted in the figure below.

- RLL diagram-style programming is the best tool for solving boolean logic and general CPU register/accumulator manipulation. It includes dozens of instructions, which will also be needed to augment drums and stages.
- The Timer/Event Drum Sequencer features up to 16 steps and offers both time and/or event-based step transitions. The DRUM instruction is best for a repetitive process based on a single series of steps.
- Stage programming (also called RLLPlus) is based on state-transition diagrams. Stages divide the ladder program into sections which correspond to the states in a flow chart you draw for your process.

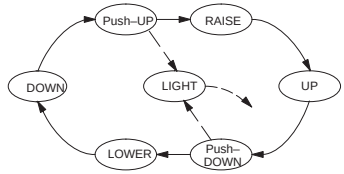
Standard RLL Programming
(see Chapter 5)



Timer/Event Drum Sequencer
(see Chapter 6)



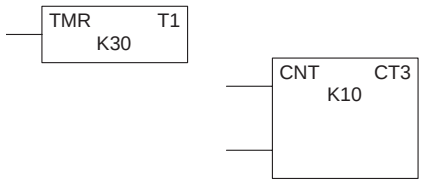
Stage Programming
(see Chapter 7)



After reviewing the programming concepts above, you'll be equipped with a variety of tools to write your application program.

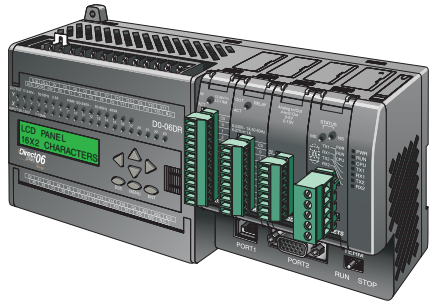
Step 7: Choose the Instructions

Once you have installed the Micro PLC and understand the main programming concepts, you can begin writing your application program. At that time you will begin to use one of the most powerful instruction sets available in a small PLC.



Step 8: Understand the Maintenance and Troubleshooting Procedures

Sometimes equipment failures occur when we least expect it. Switches fail, loads short and need to be replaced, etc. In most cases, the majority of the troubleshooting and maintenance time is spent trying to locate the problem. The DL06 Micro PLC has many built-in features such as error codes that can help you quickly identify problems.



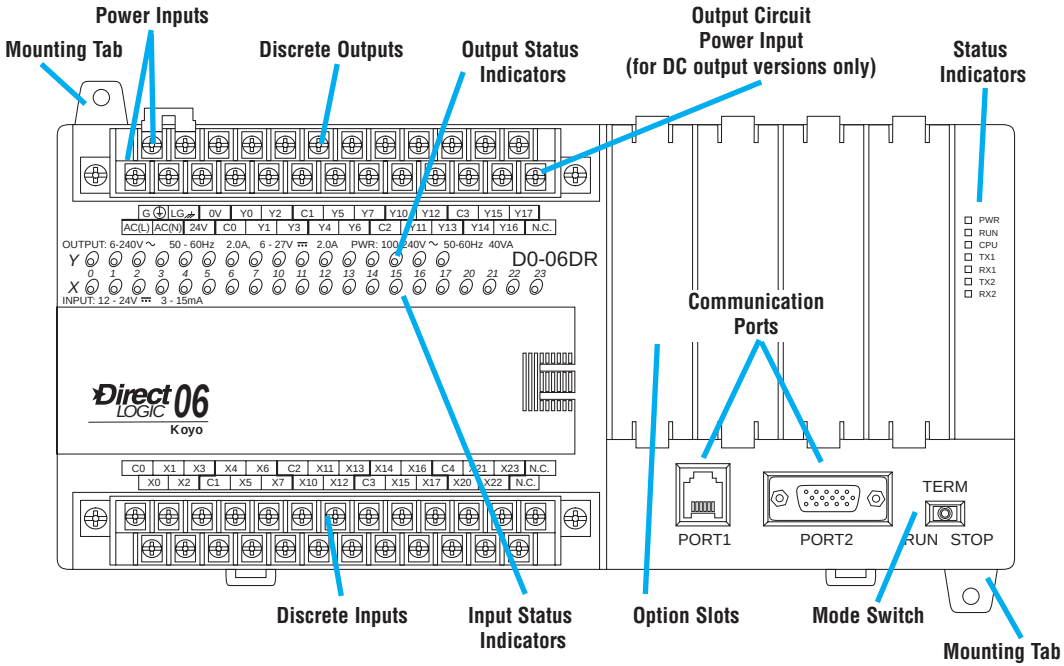
Class 1, Division 2 Approval

This equipment is suitable for use in Class 1, Division 2, groups A, B, C and D or non-hazardous locations only.

WARNING: Explosion Hazard! Substitution of components may impair suitability for Class 1, Division 2. Do not disconnect equipment unless power has been switched off or area is known to be non-hazardous.

Orientation to DL06 Front Panel

Most connections, indicators, and labels on the DL06 Micro PLCs are located on its front panel. The communication ports are located on front of the PLC as are the option card slots and the mode selector switch. Please refer to the drawing below.

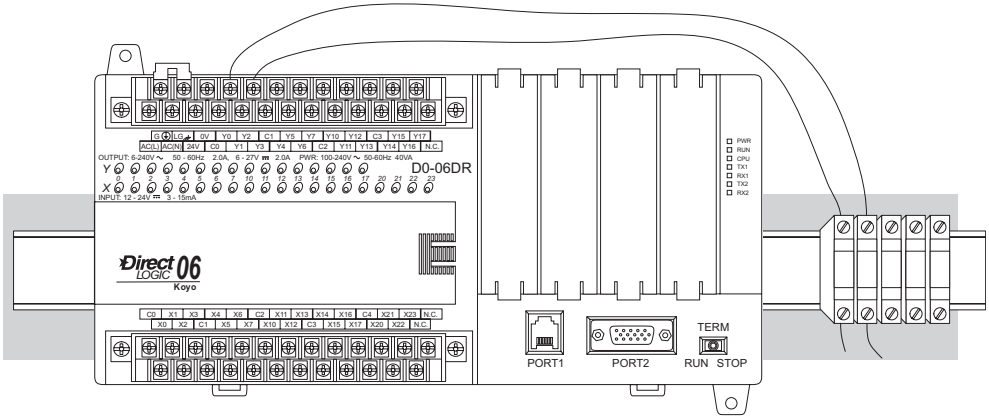


The output and power connector accepts external power and logic and chassis ground connections on the indicated terminals. The remaining terminals are for connecting commons and output connections Y0 through Y17. The sixteen output terminals are numbered in octal, Y0-Y7 and Y10-Y17. On DC output units, the end terminal on the right accepts power for the output stage. The input side connector provides the location for connecting the inputs X0 and X23 and the associated commons.

WARNING: For some applications, field device power may still be present on the terminal block even though the Micro PLC is turned off. To minimize the risk of electrical shock, check all field device power before you expose or remove either connector

Fuse Protection for Input and Output Circuits

Input and Output circuits on DL06 Micro PLCs do not have internal fuses. In order to protect your Micro PLC, we suggest you add external fuses to your I/O wiring. A fast-blow fuse, with a lower current rating than the I/O bank's common current rating can be wired to each common. Or, a fuse with a rating of slightly less than the maximum current per output point can be added to each output. Refer to the Micro PLC specification sheets further in this chapter to find the maximum current per output point or per output common. Adding the external fuse does not guarantee the prevention of Micro PLC damage, but it will provide added protection.



I/O Point Numbering

All DL06 Micro PLCs have a fixed I/O configuration. It follows the same octal numbering system used on other ***Direct***Logic family PLCs, starting at X0 and Y0. The letter X is always used to indicate inputs and the letter Y is always used for outputs.

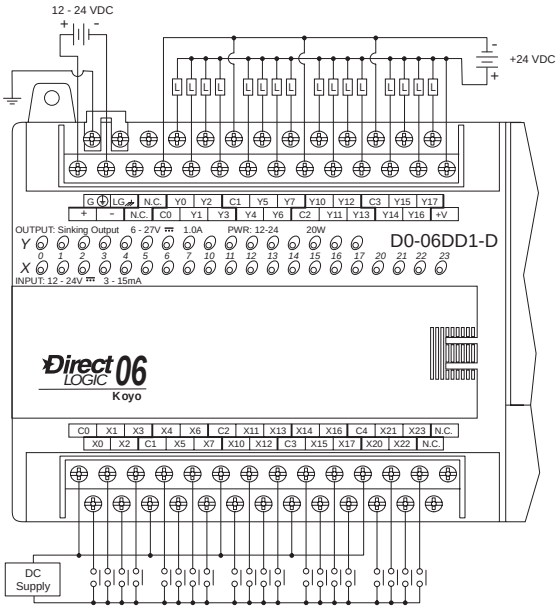
The I/O numbering always starts at zero and does not include the digits 8 or 9. The addresses are typically assigned in groups of 8 or 16, depending on the number of points in an I/O group. For the DL06 the twenty inputs use reference numbers X0 – X23. The sixteen output points use references Y0 – Y17.

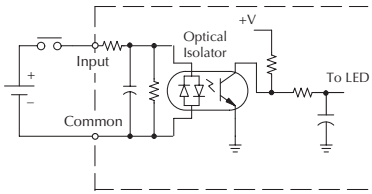
D0–06DD1–D I/O Wiring Diagram

These micro PLCs feature twenty DC inputs and sixteen sinking DC outputs. The following diagram shows a typical field wiring example. The DC external power connection uses four terminals at the left as shown.

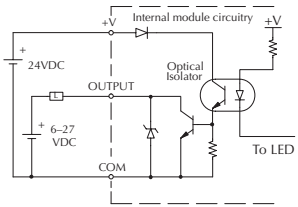
Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used.

All outputs actually share the same common. Note the requirement for external power.

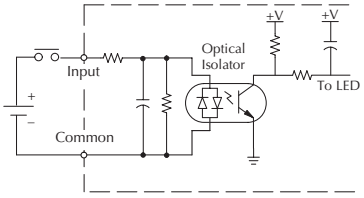




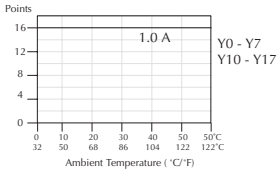
High Speed Inputs (X0-X3)



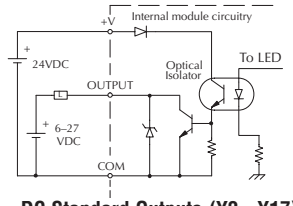
DC Pulse Outputs (Y0 - Y1)



Standard Input Circuit (X4-X23)



Derating Chart for DC Outputs



DC Standard Outputs (Y2 - Y17)

D0-06DD1-D General Specifications	
External Power Requirements	12 – 24 VDC, 20 W maximum,
Communication Port 1: 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2: 9600 baud (default), 8 data bits, 1 stop bit,odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence/print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 – 24 VDC	12 – 24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µs	N/A
ON Voltage Level	>10.0 VDC	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Max. Input Current	6mA @12VDC, 13mA @24VDC	4mA @12VDC, 8.5mA @24VDC
Input Impedance	1.8 kΩ @ 12 – 24 VDC	2.8 kΩ @ 12 – 24 VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µS	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µS	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels / common x 5 banks (isolated)	

DC Output Specifications		
Parameter	**Pulse Outputs, Y0 – Y1**	**Standard Outputs, Y2 – Y17**
Min. - Max. Voltage Range	5 – 30 VDC	5 – 30 VDC
Operating Voltage	6 – 27 VDC	6 – 27 VDC
Peak Voltage	< 50 VDC (10 kHz max. frequency)	< 50 VDC
On Voltage Drop	0.3 VDC @ 1 A	0.3 VDC @ 1 A
Max Current (resistive)	0.5 A / pt., 1A / pt. as standard pt.	1.0 A / point
Max leakage current	15 µA @ 30 VDC	15 µA @ 30 VDC
Max inrush current	2 A for 100	mS 2 A for 100 mS
External DC power required	20 - 28 VDC Max 150mA	20 - 28 VDC Max 150mA
OFF to ON Response	< 10 µs	< 10 µs
ON to OFF Response	< 20 µs	< 60 µs
Status Indicators	Logic Side	Logic Side
Commons	4 channels / common x 4 banks (non-isolated)	
Fuses	None (external recommended)	